The Northwestern MILLER

MILLING PRODUCTION SECTION

Automation in the Milling Industry

By E. D. Gladow

General Mills, Inc., San Francisco

EDITOR'S NOTE: Automation is a much-discussed topic these days, and in the accompanying article Mr. Gladow points out possibilities for increased automation in the milling industry. This article is the text of a paper presented by Mr. Gladow at a meeting of District No. 10 of the Association of Operative Millers.

Automation is a comparatively new word that has become very familiar in recent months. It has been discussed in magazine articles and in newspaper editorials. It has been discussed by industrial managers and by union leaders. Even so, many people do not understand what is meant by automation. Due to its association with the push-button factory and certain complicated electronic devices, such as Univac, some people believe automation to be a very new and revolutionary development that will eliminate the need for labor in industry.

Automation is neither new nor revolutionary. Neither will it eliminate the need for labor in industry. Automation is simply another step in industrial development. It has been defined as the application of machinery to perform and control automatically and continuously some operation. Put very simply, automation is nothing more than the continuing improvement in the tools we use and have been using.

It is apparent that automation is not new when we consider the common examples of it that we have in our homes. Two of these are the thermostatically controlled furnace and the refrigerator. There are unlimited examples of automation in industry.

Why then, if automation is not new, should it be receiving the attention that it is? It is because industry is faced with a tremendous obligation to society. The use of more and better tools is mandatory for meeting the obligation.

The obligation which industry has to society is to gear itself to economically provide goods and services for some 30 million additional persons by 1965. This as one fifth increase in population in 10 years as predicted by the Joint Committee on the Government's Economy Report. The supply of these goods and services must keep pace with the demand or inflation will result. Inflation reduces the purchasing power of the dollar, and our incomes will purchase fewer of the necessities and luxuries of life. We will have a lessened standard of living. Society wants and expects a higher standard of living.

It will not be an easy job for industry to increase production by 20% in 10 years. Our country is very fortunate in having a wealth of natural resources and it should not be too difficult to provide the raw materials. The problem appears to be one of having enough workers. We have had a very high birth rate in recent years, but the youngsters will not be available to work in industry for nearly a decade. People are living longer after retirement. Labor is negotiating for shorter working hours. These factors all indicate a proportionately smaller work force for industry to employ. Industry must continue to increase automation — not only to replace the workers who will not be available, but to keep costs at a minimum for a better standard of living.

What It Means to Milling

What does all of this mean to the milling industry? It is hoped that it will mean at least a 20% increase in flour sales, and I'm sure that our industry in cooperation with the baking industry will continue all efforts to realize this increased business. Increased demands for flour should present no real problems to an industry such as ours where surplus capacity has been the rule. Our problem will be that of producing the flour as cheaply as possible, not only to maintain the per capita consumption at a high level in competition with other foods, but to compete with others within our own industry.

It is going to be necessary for top management to provide some new efficient mills and to supply the capital for modernizing and increasing automation in our present mills in order to keep costs at a minimum. The assistance of top management will be needed to work out the problems of installing swing shifts or the like to avoid the payment of premium time for Saturday and Sunday work. Ours is one of only a few industries that has not fully recognized the 40-hour work week. However, much can be done at the local plant level to increase productivity. Full use must be made of the equipment available by providing additional controls to improve the efficiency of manpower. Additional equipment must be provided to replace manpower. Increased automation is necessary.

Before considering some possible applications of increased automation in our mills, it might be well to briefly mention what others have done with it.

Lever Brothers Co. has a plant in operation that is a fine example of automation. The entire operation from receiving to processing to shipping and storage is automated. Cartons of identical size are sorted by electrical eyes and palletizing is done automatically. General Mills, Inc., is building "Autofab," which is a completely automatic assembly line for assembling electronic equipment. The Richardson Scale Co. has designed an automatic feed formulation system that will mix feeds of a given formula as directed by a punched card or a record.

Partial Automation

We could study such examples of complete automation, but for practical reasons, let's look at automation as it is more generally applied. Most manufacturing plants have only certain operations of this process operating automatically. This is known as partial automation and is the type of automation that we are all familiar with. The use of automatic scales, automatic check weighers, bin level control units and metal detectors are all examples of automation in the milling industry. We also have automatic packaging and sealing equipment and the actual process of converting wheat to flour, which is so highly mechanized that it is nearly automatic.

Historically, the milling industry can be proud of its part in developing automation. Oliver Evans was a pioneer in continuous processing when he built his mill in 1783 incorporating his new inventions, the screw conveyor and the bucket elevator. Since that time our industry has continued to progress toward the fully automatic factory. In addition to the many automatic machines which have become commonplace around the mill, the newer developments in individual and battery driven roll stands and pneumatic conveying systems have made additional automation possible. The fairly recent developments in palletizing and materials handling with powered lift trucks along with bulk handling and shipping are examples of automation at its best.

It should be an accepted fact that increased automation is needed in our industry despite the excellent progress that we have made in the past. The question facing us now is how to proceed. It would be impossible for each of us to immediately hire a staff of engineers to design and install equipment at any cost to make our mills more automatic.

The economics of present day manufacturing, especially in the milling industry, require that changes be justified by savings or additional earnings. We cannot automate for the sake of automation, but surely there are many more operations in a mill that we must and will delegate to mechanics and electronics in the near future.

Packing and Loading

We are all aware of the fact that normally the largest labor cost in a mill is in the packing and loading operation. This is the area in which we have the greatest potential for man hour savings. Automation has many advantages, but a reduced payroll is the advantage that we can most easily demonstrate to top management. Savings is our most impressive argument for justifying expenditures for additional equipment. We may, therefore, conclude that the packing and loading operation should receive our first attention for applying increased automation.

This, of course, is exactly the action that is being taken in most mills, but the operations are far from being fully automatic. Bulk deliveries offer the greatest potential for labor savings and this operation should be expanded. We are limited here, however, to shipments going to bakeries and to the millfeeds delivered to relatively large consumers. It will be necessary to continue packing family flour in small packages. Labor requirements for this operation are dictated by the packaging equipment available.

Bemis Bro. Bag Co., St. Regis Paper Co., Pneumatic Scale Co. and others have made improved equipment available, but it all needs modifications to lessen the amount of labor required to operate it. Packing and sealing equipment of foreign manufacture appears to presently be our best answer for increased automation. It is claimed that a packaging machine of Swedish design will operate at high capacity completely automatically. Three of the machines require only one attendant.

Providing completely automatic and dependable packing and sealing machines should be the only real obstacle for our automating the packing operation nearly 100%. Casing, baling, conveying, sorting and palletizing are already being done auto-

(Continued on page 5a)

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Granulation and Ash Curves—Tools For Improving Milling Processes

By Dr. Otto Haltmeier

EDITOR'S NOTE: This article is an abstract of a paper read at a milling convention in Detmold, Germany, and is translated from the German publication Die Muehle. The author is technical editor of Die Muehle. In this paper, possibilities are shown for a more scientific direct control of milling operations than the much used methods of touch and visual inspection.

Grinding and screening are the primary operations in flour milling. The most direct check on these operations is a screening test. Granulation tests with the same screens as those used on the production flow sifters are commonly taken. The result of the test is usually noted in weight figures. The more industrious the laboratory, the more figures are forthcoming. In the end, the heap of figures becomes so confusing that their infelligent interpretation is almost impossible.

Granulation Analysis—I consider laboratory tests with the same numbers and quality of clothings as used on production sifters unsuitable as a basis for flow sheet evaluation; in fact, they cannot be considered a real granulation analysis. Actual granulation analysis determines only few, but accurate values, and results in a few graphic curves, rather than a multitude of numbers. The curves are independent of individual conditions, such as the sieve stacking, as long as the tests are run on test screens with accurate, known, free openings.

The values of the test are plotted on a cumulative curve, the coarsest screen (22.5% overs in Fig. 1) at the right, and the tray at the left. Once a curve has been established by connecting the cumulative percentage readings on top of the test screens, the performance of any intermediate sieve can easily be read from the curve. For instance, if the break product of Fig. 1 were to be separated by a sieve of 0.925 mm. mesh opening, about 28% would be retained and 72% would pass. Where this load does not fit the next stand of rolls, a finer or coarser screen must be selected.

Applications on Breaks—Correct setting of the break rolls is of utmost importance. Mistakes in the first three breaks can hardly be corrected in the later stages of the process. One can almost say: the entire mill is essentially in order if the first few breaks operate correctly. Fig. 2 illustrates the approximate granulation limits of the 1st and 2nd breaks in wheat flour mills. Curve "a" is indicated in the absence of wheat washing and thorough cleaning. Curve "c" promises the best results for milling after a good cleaning and conditioning. Good corrugations give less flour particles of about 150 μ when compared to another pair of rolls with inferior corrugations. Both rolls had the same weight of 1 mm. granulation products.

The second break should always accomplish a sharp reduction in size. The crease dirt is no longer present in unclean wheat. Even where clean, tempered wheat is milled it is necessary to exploit the elasticity of the skin before it becomes brittle again.

A correctly operating sifter should separate the various granulations distinctly, according to the free openings of the sieve. The best performance obtained in actual operation is shown in Fig. 3. The lower intake curve is sorted by the sieves. Theoretically, just the proportions shown on the upper right should remain. Actually, the entire curve results; the left branch of the curve indicates the imperfection of screening. Curves occasionally result from this check in which the quantity of throughs is so large that a close investigation is necessary before the output can be distinguished from the intake. Improvement of sifting, as well as readjustment of roll settings, feed, differential and corrugations, are fertile fields of application of granulation analysis in existing mills.

This type of granulation analysis has two applications in operating mills:

1. Checking the results of changes in the break system by comparing before and after tests.

2. As a tool for evaluating the performance of sifters.

The curves which have been discussed so far always apply to a single stream, the total quantity of which is considered 100%.

Another method considers the input to the first break rolls 100% and relates all later passages to this initial feed. An application of this method for a four-break system is shown in Fig. 4. All particles larger than 1 mm. go to the second break. The curve indicates that this is 90%. The readings of the original second break curve therefore must be multiplied by 0.9 if the performance of the second break is to be expressed as a part of the total break system. The third break rolls now receive only 62% of the original feed and the fourth break only 30%. The composite curves show the proportions of break products produced in the various rolls. Large proportions of certain granulations are indicated by steeply rising sections of the curves.

Ideal curves for a high milling system with little break flour and a high proportion of middlings are shown in Fig. 4. Fig. 5 depicts a break system where the second break accomplishes most of the grinding. This fact by itself may not yet be objectionable, but a check would have to be made to see if the roll length and sifting area provided are really large enough to handle the job. Surveys of this type can be made best with composite granulation curves based on the feed to the first break.

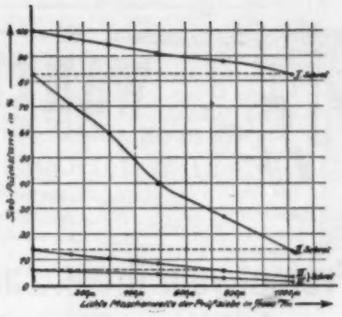

FIG. 5—Extremely heavy grinding on second break.

Ash Analysis—The ash contents of mill products are occasionally determined. This is most commonly done where two streams of similar ash content are to be combined. The ash test is usually not utilized to locate the cause of low or high ash of a stream. This would be difficult to establish from a tabulation of figures. But it is also possible to establish the ash content of the various granulations separated in the granulation analysis, and to plot the ash values as a function of granulation. A curve results which is similar in character to the granulation curve. This curve can be applied easily.

Fig. 6, top, shows the granulation curve of a break roll. The center curve depicts the ash percentages of the residues on the individual sieves; e.g., all particles larger than 1 mm. contain 2.63% ash, particles between 0.75 and 1 mm. size have 1.98% ash, etc. Calculation of the weight of ash

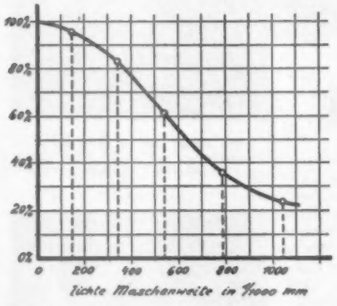

FIG. 1—Method of plotting granulation curves. Translation: Lichte Maschenweite—free screen opening.

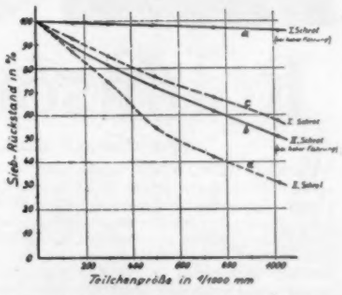

FIG. 2—First and second breaks with high and low roll pressures. Translations: Sieb Rueckstand—residue on screens; Teilchengroesse—particle size; Bei hoher Fuehrung—at low roll pressure.

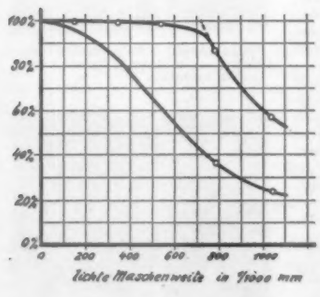

FIG. 3—Intake and output of a sifter.

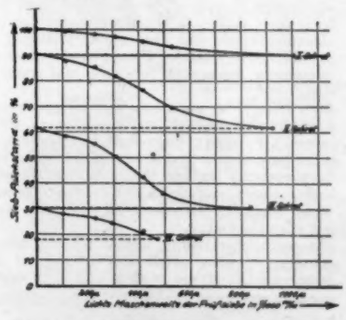

FIG. 4—Granulation curves based on feed to first break. Translation: Lichte Maschenweite der Pruefsiebe—free screen openings of test screens.

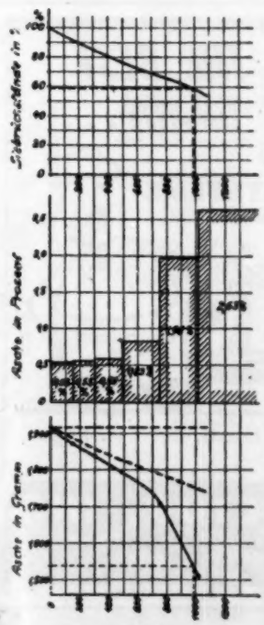

FIG. 6—Ash curve with corresponding granulation curve. Translations: Asche in Gramm—ash, grams; Asche in Prozent—ash, %; Siebrueckstaende—residue on screens.

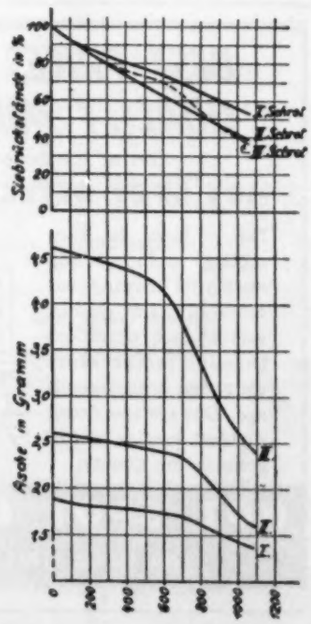

FIG. 7—Ash curves of three breaks, showing characteristic bends.

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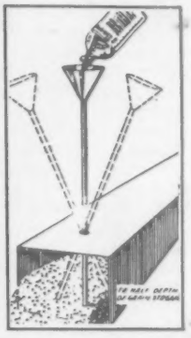

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results in the curve at the bottom of the illustration; e.g., 59 × 2.63/100= 1.55 g. ash for the first point.

The difference of residue between the first and second points on the granulation curve is: 67—59=8%. To find the amount of ash for the second point, we repeat the previous calculation with the new values: 8 × 1.98/100=0.16 g. The second point on the cumulative ash curve is the ash of the first screen residue plus the ash of the second screen residue: 1.55 + 0.16=1.71 g. This operation is

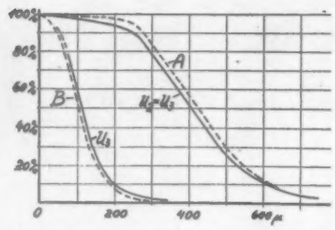

FIG. 8—Granulation limits of middlings reductions.

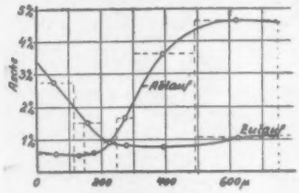

FIG. 9—Ash percentages found in various particle sizes in feed and output of a middlings roll. Translations: Ablauf—output; Zulauf—feed.

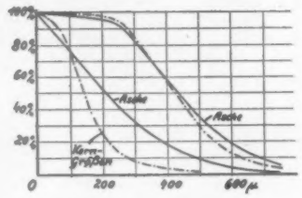

FIG. 10—Granulation and ash curves for feed and output of a middlings reduction. Translation: Korngroessen—particle size.

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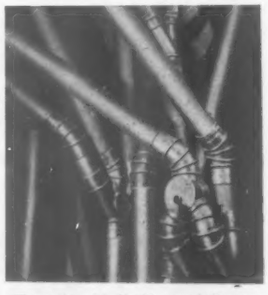
'Pneu-Flow' can be used for smut department or mill. This shows a line of mill system cyclones.



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continued until all the points on the ash curve are plotted. The curve terminates at 1.92 g. ash, the total weight of ash in the 100 g. probe.

Intermediate values can be interpolated in the ash curve just as in the granulation curve. If a screen with 600 μ openings would separate this product, 72 g. of the product, containing 1.77 g. ash would be retained from a 100 g. sample. A steeply inclined curve indicates increased ash content. The kink in the curve clearly shows the granulation at which an increased proportion of epiderm particles is encountered. This is the logical point of separation. Great potentialities for flow improvement hinge on a recognition of this bend in the curve.

The inclined dotted line above the ash curve (Fig. 6, bottom) would be obtained if pure flour were handled. The divergence of the ash curve from this line tells the amount of ash. In the very small particle sizes, some powdered ash spreads the two curves at an initial angle. After the curves run almost parallel for a short time in the medium fine range, the angle of divergence becomes considerably larger in the coarser granulations.

Fig. 7 shows ash curves of three breaks. The ash values increase sharply in the later breaks after middlings have been withdrawn. All curves show the characteristic bend; it increases in intensity with mounting ash.

Granulation and Ash Analysis in Reductions—Fig. 8 shows the coarsest feed "A" and the finest output "B" found in reduction streams in a number of mills. Curve "A" contains almost no flour, indicating that the preceding sifter operated very effectively. Most mills accomplish less than ⅔ of the reduction from curve A to B in the composite picture. The best single mill reduced from μ_2 to μ_0.

An analysis of the ash proportions in the reduction of middlings can also be made. Fig. 9 illustrates ash percentages in input and output in a full chart illustrating the usefulness of the process. The high proportion of ash powder in the fine section of the inlet is diluted in the output by a large weight of milled flour. It therefore amounts to a much smaller percentage in the output. Little grinding of the large bran particles occurs. The end product of the passage therefore features largely coarse bran, but few large endosperm particles; the ash content in the right section of the curve rises sharply. Fig. 10 shows ash analysis curves of a reduction. The method of plotting is the same as that for the breaks (Fig. 6). The ash values are expressed in per cent of the total ash of the stream.

If the ash were equally distributed along the entire granulation band, identical curves would result for granulation and for ash. The two curves actually intersect, indicating the advantageous uniformity of ash distribution. The output curve (left) shows that 50% of the weight lies in the granulation range of 100 to 200 μ, but only 23% of the total ash is contained in this range.

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CAMBRIDGE, MD. — Thomas M. Creel has been appointed sales engineer for the Cambridge (Md.) Wire Cloth Co., to cover the seven-state southeastern territory. Mr. Creel will represent the full Cambridge line, consisting of woven wire conveyor belts, industrial wire cloth and special metal fabrications. His headquarters will be in Atlanta.

AUTOMATION IN MILLING

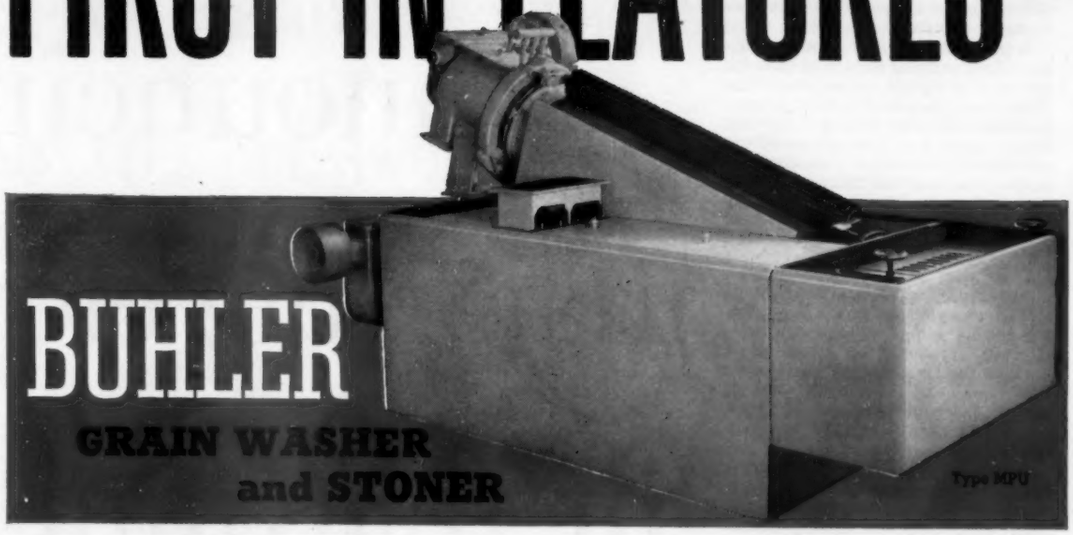
(Continued from page 1a)

matically. The packing crew of the future should consist of a mechanic and one or two attendants for an average size mill. The loading crew should not be much larger than this. Powered lift trucks will handle most materials after being palletized automatically. Labor will be required for operating the trucks and for some odd jobs such as handling broken bags and closing box car doors, but we should be able to eliminate other jobs such as car coopering through the use of specially designed box cars that are limited in use to edible food products.

Processing Department

Automation of the packing and loading operations will probably be slow because of the need for capital expenditures to provide the equipment. Meanwhile, we should be studying the processing department. We cannot expect to effect any great labor savings here as comparatively few men are involved. Labor savings, however, are only one of the advantages of automation. Automatic equipment and instrumentation can assist in producing a consistent high quality product at a constant maximum rate. Automation can help to maintain top milling performance. These advantages can be worth more to a milling company in increased earnings than the savings realized from a big payroll reduction. They

FIRST IN FEATURES—



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are, however, less tangible and more difficult to evaluate in dollars. Heavy expenditures would be hard to justify.

The average mill operator does not need to start thinking in terms of complicated and expensive equipment as the first step for increasing automation. Our flour mills were designed to operate nearly automatically. At least, they were designed to operate continuously. Anything which can be done to improve or maintain the continuity of operation should be the first step. Choke-ups are too often accepted as a normal part of milling. They should not be. They should be eliminated as they cause interruptions in production, create extra cleaning labor, damage equipment and produce substandard products. A record should be kept of all choke-ups. This record will usually indicate that three or four trouble spots are the cause for 90% or more of the choke-ups. Once these spots are located, they can usually be corrected at small expense.

A preventive maintenance program to include periodic inspection of belts, conveyor gudgeons, roller chain and gear drives in addition to a planned program of roller mill, purifier and sifter repair can help to avoid unscheduled shut-downs. Unscheduled shut-downs and the following start-ups along with choke-ups are very expensive.

Analyze Functions

Only after a mill is operating as automatically as it was designed to, should thoughts be given to providing more automatic equipment. Then it would probably be advisable to analyze the functions of the various workers to see if at least some of their duties could not be done better and at less expense by suitable equipment.

Cleaning labor is non-productive labor and yet it usually makes up ¼ to ⅓ of the milling department's labor cost. This can usually be reduced by controlling chokes and unscheduled shut-downs. Maintaining and improving the mill suction systems will also help to keep the mill clean. Consideration should be given to pneumatic conveying systems, especially in new construction, as machines are then kept on a negative pressure and less dust escapes to dirty the area.

Lubrication usually requires the attention of one or more employees. This job can be handled entirely automatically by installing a piping system. It can be made to function at timed intervals. Fumigation can be handled in much the same way.

Several men are normally involved, either full or part time, in feeding in ingredients, choke stocks, rejected flours or flours for stuffing. Too often these operations are entirely manual and unreliable. Bulk bins equipped with automatically controlled feeders should be provided to avoid unnecessary handling of materials and to make for more accurate control of the material being fed in.

Wheat men spend a large portion of their time running from bin to bin checking wheat levels and operating slides and valves. Equipment is available for doing this work automatically and dependably through a system of indicators, solenoids and other devices which could be operated from a central location.

Water is added to wheat for conditioning purposes through various devices, many of which are quite crude. Methods for determining moisture content are usually quite accurate but are too time-consuming. Surely equipment is available or can be made available for automatically adding correct amounts of water as determined by a continuously operating moisture testing device and a wheat stream scale.

Functions of the millers and bolters or grinders and spouters whatever they may be called, usually include changing valves and slides, taking scale readings, figuring extractions and percentages. Equipment and instruments are available which we should be able to apply to do this work automatically and accurately. We have automatic dump scales and continuous stream weighing devices, all with means for recording or totaling the amount of stock passing through them. These recorders can be remotely located at any location. They can be made to provide a permanent chart record or the wheat and flour scales can be instrumented to give a continuous yield or extraction figure. The milling superintendent or plant superintendent of the future will be able, while sitting at his desk, to tell at a glance how well the mill is performing at any given time.

Study Present System

The actual milling process of converting wheat into flour is the one area in our industry that presents a real automation problem. The simple answer would be to develop a revolutionary method of milling that would eliminate the element of human judgment. There is no evidence of such a development. Until there is, we should study our present system for possible applications of equipment for automatically controlling the operation. Instruments can do a much better job than humans as they can be made to detect any small change in the many variable factors affecting milling. Most of these factors, some of which are moistures, temperatures, humidities and physical characteristics of the wheat, need to

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It is now possible to fumigate grain with methyl bromide in silo-type grain elevators.

Dow's new method of forced recirculation enables the operator to disperse an even flow of methyl bromide air mixture through the grain mass at a given rate per bushel per minute. The new process is quick, uniform, sure. It takes the guesswork out of grain fumigation because it is *engineered* to make fumigation of bulk commodities an exact science. Controlled distribution of methyl bromide means lower dosage . . . *cuts material cost at least 50 per cent* . . . and gives complete kill of all insect life in the bin. *There is no question about results.*

Dow was the first fumigant manufacturer to work on this important new process. We have tested the forced recirculation method using methyl bromide in many types of installations for more than seven years. As a result, Dow is an authoritative source of information and technical assistance. This is a major development in the fumigation of grains, and should also have application in the fumigation of peanuts, popcorn and other materials stored in bulk. Our tests have proved conclusively that when the installation is properly engineered and the amounts of methyl bromide used are correct—*there is no question about results.*

make a radical change before being recognized by man. Instruments are on duty full time as they have no need for lunch or smoking periods as compared to man.

Milling has often been referred to as an art, and millers have been called artists. These references have been true as the application of special skills have been part of the job. Is this necessary? Is this as it should be? A modern manufacturing industry should operate basis scientific evaluations and applications. What does a miller do that is so difficult to perform scientifically? Basically, he performs on-the-spot quality and quantity estimates and adjusts machinery by guess to effect the results. He periodically calculates the flour percentages and has the results of some scientific laboratory tests to guide him. He usually has some established break extraction figures to work with, but for the most part he is on his own to use his judgment and experience for achieving satisfactory results.

The results achieved are usually quite satisfactory by present standards, but we cannot afford to be content with these standards. We can do much better. Why do we, as an example, get a high percentage of quality flour some days and a low percentage on other days? There are, of course, good reasons for these variations, the primary reasons being variations in the wheat, weather conditions and operating troubles. Operating troubles can be held to a minimum by following good operating procedures and by the use of additional controls and instruments such as those which have been mentioned. The losses in yield and production due to unfavorable atmospheric conditions can be minimized through the use of air conditioning. This leaves us with the problems related to the variation in wheat.

Our raw material, wheat, is an extremely variable material and has been responsible for our operating the mills by rule-of-thumb methods. We have had no choice but to assign millers to continually experiment with the various wheat mixes because we have no means for predetermining milling characteristics. It is true that we can estimate quality and extractions through experimental millings and laboratory tests, but how can we determine the grinding pressures and roll spacings needed? We should develop some device for doing this and then instrument it to automatically adjust the grinding rolls as needed. A development such as this may never be more than a dream but it could save us money and production that we are now losing.

Extractions, production and quality usually suffer while the mill is being adjusted. The miller makes the adjustments to the best of his ability but is unable to determine the results obtained until the wheat is through the mill and very often it is several hours later before the extractions are figured or quality tests made. Sometimes it is days before he knows the actual results.

As we have no present means for predetermining the behavior of wheat on the mill and eliminating the losses caused by changes in the wheat, we should do the next best thing. We should minimize the losses by decreasing the time involved in determining results. This will require additional scale equipment and instrumentation to give us quick answers. There is practically no limit to the applications of scales for mill control other than their cost. We should use them to automatically indicate the degree of grinding, to indicate the volume of key streams, as well as to indicate the total overall performance of the mill. We should be able to instrument scales and grinding rolls to automatically give the desired extractions.

I have mentioned only a few of the possibilities for increased automation. They have been mentioned as food for thought, and we should be thinking. Several of the suggestions made are already in use, but only in limited ways. Some may be impractical and too expensive. Others may suggest additional ideas for application of controls, and equipment to better the milling industry as a whole. That is the real purpose of this paper—to stir the imagination and solicit the cooperation of all millers for working towards a more automatic factory that can better meet the demands of the future.

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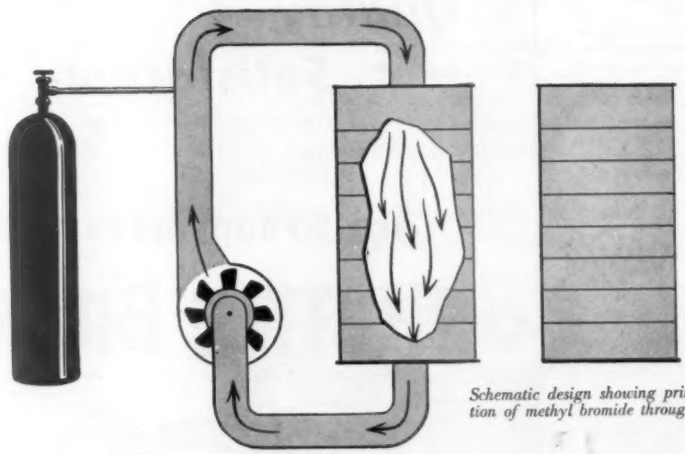

Schematic design showing principle of recirculation of methyl bromide through silo bin.

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Postwar Bread and Recent Developments In Cereal Chemistry in England

By Dr. D. W. Kent-Jones

EDITOR'S NOTE: Many millers as well as cereal chemists will be interested in the data and comments in the accompanying article by the well known English cereal chemist, Dr. D. W. Kent-Jones. This article is the text of a talk by Dr. Kent-Jones at the 1955 annual meeting of the American Association of Cereal Chemists.

Modern war brings about many problems other than those dealing immediately with defense against enemy action or offensive action against the enemy. No war, so far, has illustrated "Total War" more than the last conflict, 1939-1945. As far as we, in that little but important island off the coast of Europe proper, were concerned, everyone was seriously affected, soldiers, sailors, and airmen, civilians, men and women of all ages, and children. We in Great Britain live by exporting manufactured goods made largely from imported raw material, and we also import the greater part of the food we eat, which, of course, is paid for by our exports.

When we were besieged, as we were by enemy submarines, we had to adjust our economy very considerably, and bread, as the main food of the nation, had to undergo changes. It would have been easy to have said that during the war all the available wheat would have to be ground into whole-meal, but such an action would have been stupid. Wheat offals provide valuable feeding stuffs for farm animals that provide us with milk, meat, eggs, etc. Some sort of compromise based on scientific knowledge and experience was wanted, and attention had to be paid to the requirements of humans, animals, and the suitability of food to both, so as to

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obtain the best possible use of the restricted food available.

In the first few months there was little interference, but then the law demanded that extractions had to be increased; firstly to 75%, and then to 85%. At one time it reached 90%. After the war things were really little different, for, if submarines no longer sank grain ships, we had the greatest difficulty in finding the overseas currency to pay for food and again the maximum use had to be made of that which we were able to buy.

Post-War Loaf Report

After the war the whole question of flour and bread was discussed by the millers, bakers and flour importers, together with the ministries concerned and particularly with the nutritional authorities and the Medical Research Council. The outcome was the "Post War Loaf Report," on which the bread policy of the nation is still based. This, to some extent fantastic, report has been discussed by me on many occasions.

Some of the statements made were blatantly open to criticism, but it should be remembered that a misguided but well-intentioned effort was made to issue an "agreed" report. It was realized that the people wanted and were entitled to have a more attractive loaf than that they had had to put up with during the war, and it was hoped, if 80% extraction was agreed upon, that the bread would not be too bad a color and that certain nutritional standards would be attained. It was hoped that, if suitable milling methods were employed, each 100 g. of flour would then naturally contain: 0.24 mg. Vitamin B, 1.60 mg. nicotinic acid, 1.65 mg. iron. And the nutriment authorities comprised on this level.

At one time it was also hoped that such 80% extraction flour would also contain a reasonably high level of riboflavin, but when this was found not to be so, the weak excuse was made that cereals never were a good source of riboflavin and with the better consumption of milk there should be no lack of riboflavin in the diet and no need for flour to reach a certain standard in this respect.

Modern Trends in Milling

Let me, however, revert to what happened in the war years. There has been, in my opinion, more advance in the technique of milling in Great Britain as a result of war experience than in the U.S. Although we learn very much when we visit the United States and Canada, I hold strongly to the belief that in Europe milling has reached a very high level. This is largely because, especially with the British miller, they have to deal with all sorts and conditions of wheats imported from all over the world. My view therefore is that the British miller is exceptionally experienced and able, and British milling engineers are among the best in the world.

When first we had to mill to 85% extraction, it was thought that we should have to eat a brown loaf made of, in effect, a fine meal. In fact, for the first few months this is what happened. Suddenly, one or two millers produced not an 85% meal but an 85% flour. This 85% flour was much whiter and finer than had been expected. Indeed, when this was first made, I can assure you that even the Ministry of Food queried whether this product did really contain 85% of the grain. How was this done? Progressive millers found that, by milling a little drier and by greater break releases at the head of the mill, they were able to use the lower breaks more and more as scratch rolls and were able to clean up bran better. In other words, it was preferable to scratch off more dirty endosperm from which flour could be made than to grind up offal.

In general—

(1) Wheat was carefully conditioned but it went on the mill rather drier than before.

(2) The four-break system was increased to five breaks and it usually paid to divide the breaks into coarse and fine, i.e., to divide the feed, so that, for example, the second, third, and fourth breaks each had fine and coarse feeds.

(3) The tendency was to increase the scratch system so as to follow more thoroughly what is really the logical system of milling and hence to release as much endosperm from the outer skins of the grain as possible.

(4) To run on to purifiers somewhat heavier feeds than usually and to purify heavily. I am a strong believer in the European system of extensive purification.

Within a week or two of the new 85% flour, as opposed to the 85% meal, coming on the market, all the millers had to change and produce the new type flour if their product was to produce bread as bold and as bright as that of their rivals. Nor, if the full extraction was obtained, did the nutritive value fall, for it is the endosperm near the branny material and the scutellum rather than the germ proper that are rich in the desirable vitamins and especially so in B_1. In this respect, the excellent work of Hinton of the Millers Research Assn. at St. Albans is well known. There is much less nutrition for humans in the branny coverings of

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Table 1—Composition of Diets in Terms of Foodstuffs

Foodstuffs—	Average amount eaten (g. per day) Duisburg	Vohwinkel	Prewar British children 9 to 10 years old
Meat (cooked weight)	6	7	86
Fish (cooked weight)	11	22	24
Cheese	7	5	8
Milk (mostly skimmed)	82	113	450 (whole)
Butter and margarine	12	91	30
Jam	53	43	24
Sugar	5	58	78
Orange juice (concentrated)	20	20	0
Potatoes	168	257	113
Root vegetables	36	38	11
Green vegetables	63	98	28
Dried pulses	2	6	4
Fruit (fresh and dried)	13	24	142
Semolina (for soups)	34	36	
Experimental flour:			
100% extraction	447	250	127
or 85%	437	...	
or 70%	418	240	

the grain, and great progress in knowledge was made by painstaking dissections of the grain and micro analysis of the various components.

However, it has to be remembered that whatever unexpectedly good color standard was reached at 85% extraction, the flour was still dull compared with the more usual lower extraction flour to which we were accustomed before the war. Some time after the war, and I am now speaking of the last few years, the extraction was dropped to 80% and control was not carried out so officiously and effectively as during the war—and then a new problem arose.

Certain very modern mills incorporating all the latest ideas, including pneumatic conveying, were able at 80% extraction to make a much whiter flour than the ordinary and older flour mills. The bakers' demand for this brighter and less dull flour was such that the ordinary miller lost trade. Naturally, he was not prepared to lose trade and, as the flour order was somewhat ambiguous, he cut his extraction to make his flour just as good. The miller with the new mill cut his extraction to the same extent and again had an advantage. In the long run, the mills in Great Britain today are not now extracting anything like 80% of flour—probably the average is nearer 74-75%. At present it would appear that negotiations are proceeding between the Ministry of Food and the millers, since in effect the ideals set out in the Post-War Loaf Report are not now implemented.

The matter can perhaps best be explained if I describe the position in terms of color of flour as recorded by the Kent-Jones and Martin Flour Color Grader, since this instrument is now used extensively in Great Britain and most European countries, the British Empire and a great number of other countries. In Great Britain it is invariably employed to report on flour color, and it is used by the government laboratory acting for the Ministry of Food, the official research associations and the millers and bakers generally. It has almost completely superseded the outmoded ash test which is only an indirect measurement of color and is a much more time-consuming test. It is almost impossible to control and check length of milling extractions analytically, and this is why during the war the millers had to make comprehensive milling returns, check stocks, etc. However, this new assessment of color does throw some light on the subject. Ash tests are not now popular in Great Britain. Ash tests have never been worshipped with the reverence you have shown for them in your country, and now that all flour must contain 14 oz. per sack (280 lb.) of creta praeparata (chalk) the ash test means little or nothing, since chalk mixes in so unevenly with flour.

Control of milling is recorded now almost invariably by the color grader, and it is my belief that this or other similar system will be used before long in the U.S. and Canada. It is not my intention to describe the instrument, which is a reflectometer utilizing flour in paste form, and the recording of the results by means of photoelectric cells working on a cut-off mask to register a null point. On the empirical scale used, top-patent flours record about 0 to 1.0 Kent-Jones and Martin units, ordinary straight-run white flours give figures of around 1.5 to 2.5, and the original true 80% flours around 5.0 to 5.5 or 6.0, according to the nature of the wheats and the efficiency of milling. The wartime 85% flours were around 7.5 to 8.5, and the entire scale goes from —5.0 to 18.0. The test takes about 2 minutes to make, and each increase of one Kent-Jones and Martin unit is a reduction of 1.75% in the reflectance.

At present, because the true 80% extraction is not being attained, what is called "national" flour varies from 2.5 to 4.5, and in consequence, being much brighter and whiter than true 80% flour, the flour does not reach the standard in B_1, nicotinic acid and iron required by the Post-War Loaf Report. Nevertheless, the work of the Research Association of the

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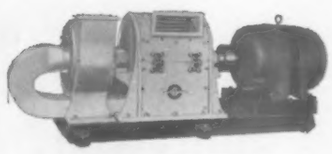

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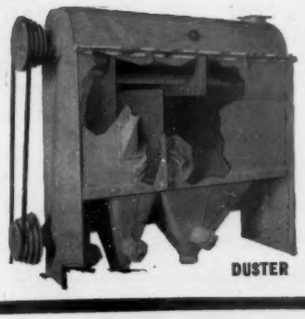

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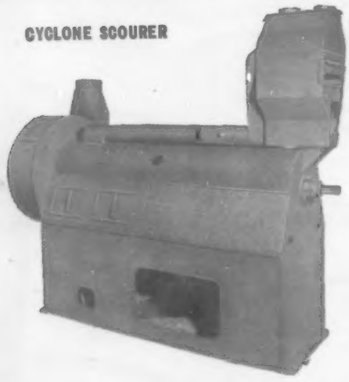

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British Millers, the government laboratory and my own laboratory has shown that if the Ministry of Food requirement was for flour to be milled to a grade figure of 5.5 (extractions varying in different mills to obtain this color), then the flour would contain the required degree of nutrition set out in the Post-War Loaf Report.

What will eventually happen it is certainly not for me to attempt to prophesy, especially as I am on certain committees and am asked to advise, but something must be settled soon. A particularly stupid position has arisen because the bread made from "national" flour, meant to be 80% extraction (but at the moment, in practice, of lower and varying extraction), is subsidized, while if white flour is used, there is no subsidy on the bread produced. The 1¼ lb. "national" loaf is sold at the controlled price of 7½d., and the subsidy used to cost about £43,000,000, which comes to about 2¼d. per loaf. The tendency is for the subsidy to drop as the price of wheat falls. White flour has since Aug. 30, 1953, been permitted, but it must be fortified by the addition of an agreed master mix so that the flour reaches the standard of the Post-War Loaf Report in B_1, nicotinic acid and iron. Hence, we have now reached the position of unsubsidized bread made from white flour being of higher nutritive value than the subsidized National loaf—i.e., the exact reverse of the position intended.

The composition of the agreed master mix is:

	% by weight
B_1	0.74
Nicotinic acid	3.53
Iron (Ferrum Reductum)	3.14
Filler (good home-milled top-patent flour with a moisture content not exceeding 10%)	92.59

If this is added to ordinary straight-run white flour of about 72% extraction as we had in prewar days at the 1 oz. per sack (280 lb.), the flour will reach the Post-War Loaf Report standard. For top (short) patent flour the master mix is used at the rate of 1.1 oz. per sack (280 lb.).

McCance & Widdowson Report

Finally, I feel that I must recall to you the first recommendation of the Post-War Loaf Report:

"(1) How low-extraction flour suitably reinforced with the 'token' nutrients compares from a nutritional point of view with high-extraction flour obtained wholly from the wheat grain. In this connection consideration will, of course, have to be given to information which may be available as to the results of the widespread use of reinforced flour in the U.S."

To investigate this problem the Medical Research Council designed a special test mainly on 150 young German girls in two orphanages (Duisburg and Vohwinkel). Five experimental flours were used:

1. 100% extraction flour.
2. 85% extraction flour.
3. 70% extraction flour.
4. 70% extraction flour enriched with vitamin B_1, riboflavin, nicotinic acid and iron up to the amounts of these substances present in the 100% extraction flour.
5. 70% extraction flour enriched with the same substances up to the amounts present in the 85% extraction flour.

At Vohwinkel the bread comprised only 35% of the total diet, but the children enjoyed a greater quantity of sugar and other foods.

The composition of the diet in terms of foodstuff is shown in Table 1.

The composition of the experimental flour was as shown in Table 2.

It will be noted that the additions of creta (in the high-extraction flours) were in excess of 14 oz. per sack. The actual additions were: Whole meal, 37 oz. per sack; 85% extraction, 17 oz. per sack; 70% extraction, 10 oz. per sack.

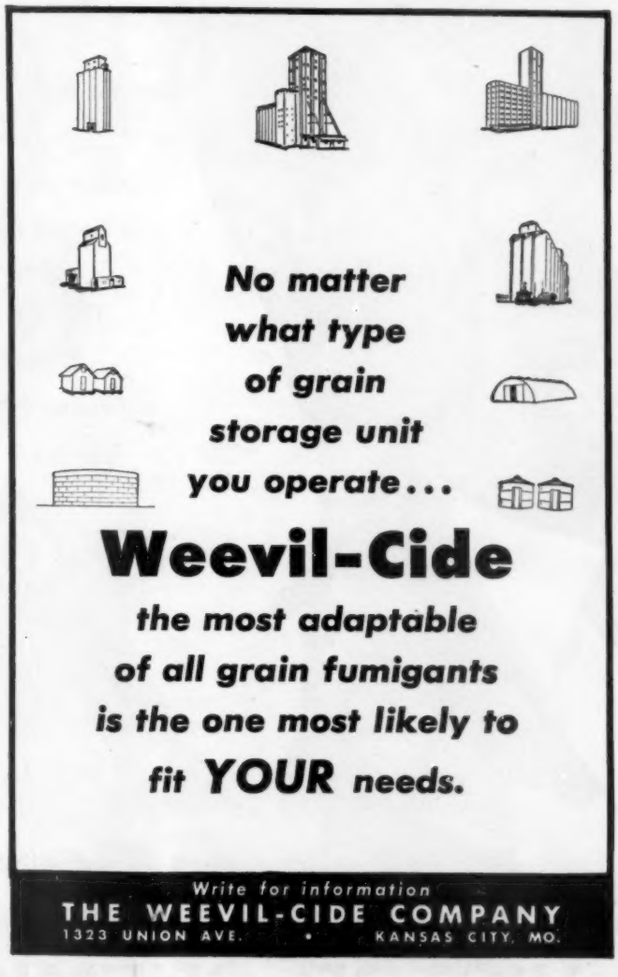
At Duisburg the diet of these children contained but little milk or other animal protein, but about 75% of the caloric value of the diet was in the form of flour products. In other words, they lived on the semistarvation diet then prevalent in Germany; but this was supplemented by as much of the different breads as they desired. I must emphasize that the test was made on human beings over a period of a year, and that the test, especially devised to answer the riddle of the comparative nutritional

Table 2—Composition of Experimental Flours

Extraction rate of flour	Moisture	Protein	Fat	Vitamin B_1	Riboflavin	Nicotinic acid
	(g/100 g)			(mg/100 g)		
100%	11.8	12.0	2.92	0.41	0.15	5.0
85%	12.2	11.8	2.77	0.34	0.08	2.9
70%	12.4	10.9	1.90	0.15	0.46	1.9
70% (enriched to 100% level)	12.4	10.9	1.90	0.41	0.10*	5.6
70% (enriched to 85% level)	13.1	10.9	1.90	0.34	0.07*	3.4

Extraction rate of flour	Calcium (incl. added creta)	Magnesium	Phosphorus	Iron
	(mg/100 g)			
100%	376	131	307	4.41
85%	193	77.5	192	2.84
70%	109	34.0	108	1.70
70% (enriched to 100% level)	109	35.2	108	4.20
70% (enriched to 85% level)	109	36.3	108	2.67

*The figures for riboflavin are unsatisfactory, but we cannot account for these two discrepancies, particularly as all the other vitamin additions were found to be correct.



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value of white and brown bread, was extremely comprehensive. Full clinical tests were made at three monthly periods, haematological and careful biochemical tests took place, radiological examinations carried out, dental examinations made; and indeed, it is difficult to imagine a more thorough and impartial test.

Values Shown

Never before in the history of the world has there been so clear a vindication of those who favor white bread, so loved by the mass of the public; never before has the bogey of the alleged enormous nutritional superiority of long-extraction brown bread been so completely exploded by those who were quite certain that the result of the test would be the other way round.

I quote a few extracts from this report:

"Two outstanding conclusions may be drawn from these experiments. Firstly, no differences either in growth or health could be detected between the groups of children eating the various kinds of bread; secondly, all the children did remarkably well on these diets which by commonly accepted standards would be considered very poor."

"One of the most striking findings in these investigations, and perhaps the most unexpected one, was the remarkable way in which the general condition of all the children at Duisburg improved during the year of the experiment. It was stated in the report that distinguished medical visitors 'saw the children towards the end of the experiments, and all agreed that they were in excellent physical shape. They were unable to pick out individual children as belonging to a particular bread group. At no time was there any digestive upset which might have been attributed to the diet'."

"At the time when the experiments began, it was not anticipated that all the children would improve as much as they did. In fact, it was thought that some might deteriorate. The standards used for clinical gradings, therefore, were chosen in relation to the general condition of the children in the orphanage at the first examination, so that the middle class, B, contained the largest number of children and there would be room for improvement or deterioration. The children improved at both homes, and it would be impossible for these results to say that the group on any one bread did better than any other."

"During the experimental period in both orphanages the increase in caries was trifling in all the bread groups, and it may be concluded that the experimental diets did not affect the teeth adversely."

"The gains in height and weight of the children in the different bread groups have been expressed by comparing them with the 'normal' rates of increase of the American children."

"The group having unenriched white flour did not do worse than the others. Any failure to grow, therefore, was not due to lack of something which was supplied by one type of bread but not by another."

"Probably the most important finding concerns the high nutritive value of wheat in any of the forms customarily consumed by man."

I have already expressed my view that most people will be excused if, after reading this report, they doubt if any kind of bread is likely to be dangerous to folks living a normal life, or that under ordinary conditions it is better to eat one type of bread than another. This report has gone a long way to discredit an argument often put forward that, if white bread is used, even if enriched, some "unknown" factor may be missing from the dietary. If white bread is consumed and this results in an "unknown" factor being missing, then the results obtained on the girls in the two German orphanages seem to show conclusively that the missing unknown factor cannot be of any real importance; it does not affect children over the space of a year. It is not as if at the end of the year the children had only been moderately good—they were in excellent health and show first-class growth.

It must be confessed that there are some unexpected results in the McCance & Widdowson Report. Why, in some respects, does it differ so markedly from the report of the Newfoundland experiment that showed up enrichment to such advantage?

I feel I must point out that it was anticipated that the investigation would show up white bread in a most unfortunate light — in fact, several thought that the test was a serious and dangerous one to make on the children of a defeated nation; but it was very closely watched and, if decline in health had showed, there is no doubt that the test would have been halted. But what an outcry against white bread would then have been raised! Actually the report was completed in 1948 but it was not published until 1954 and then only after pressure had been put on the authorities by the millers. Can you wonder that many millers have wondered what is the justification, if bread is subsidized, for this to be restricted to the national loaf and for the white loaf to be unsubsidized?

It would not be right to conclude this paper on recent developments in cereal chemistry without making

Advertisement

INSIDE SCIENCE

The Vital Story of FARINA and PASTINA ENRICHMENT

by Science Writer

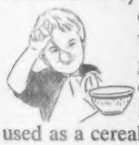
This article is one of a series devoted to the story of vitamin enriched or restored cereal foods; white bread and rolls, white flour, corn meal and grits, macaroni products, white rice, breakfast cereals and farina.

What is Farina? Sometimes called the "heart of the wheat," farina is wheat (other than durum varieties) which has been ground and bolted in granular form and from which virtually all of the bran coat and germ have been removed.

It is an excellent source of food energy, providing 370 calories per 100 grams. Its composition is largely carbohydrate (77.4 grams per 100 grams) with some protein value (10.9 grams per 100 grams) and low fat content.

This excellent, palatable food makes a fine dish for infants and children at any meal. For adults it is particularly good as a breakfast food when served with cooked or dried fruits. Being bland, it has a special place in the diets of the elderly and invalids of all ages.

Pastina Defined. Pastina is the product which is derived from durum wheat and with which egg yolks and sometimes other ingredients are processed. It, too, is an excellent food for babies and children and has a special place in adult diets, being used as a cereal or by being added to soups and broths.



Why Enrich Farina and Pastina? Because so much of the vitamin and mineral content of the wheat is contained in the germ and bran which must be removed to make farina and pastina, enrichment to restore important values is absolutely necessary.

New Enriched Farina Standards. The Food and Drug Administration of the U. S. Dept. of Health, Education and Welfare in June of 1955 changed the standards which all *enriched farina,* sold in interstate commerce, must meet. The new *maximum* and *minimum* levels (in milligrams per pound) are:

	Min.	Max.
Thiamine (vitamin B_1)	2.0	2.5
Riboflavin (vitamin B_2)	1.2	1.5
Niacin	16.0	20.0
Iron	13.0	*

*No maximum established

In addition to the above, the F. & D. A. allows the addition of other food elements at the manufacturer's option. Among these are:

Vitamin D..250 U.S.P. units per pound
Calcium ...500 milligrams per pound

Enriched Pastina. Enrichment requirements for macaroni and noodle products, of which *pastina* is one, are as follows. All figures are in milligrams per pound and include allowances for losses which may occur in cooking. These are standards established for the consumer by the Food and Drug Administration.

	Min.	*Max.*
Thiamine (vitamin B_1)	4.0	5.0
Riboflavin (vitamin B_2)	1.7	2.2
Niacin	27.0	34.0
Iron	13.0	16.5

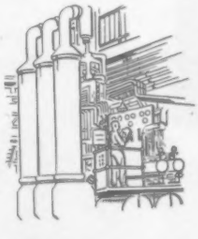
Again, the F. & D. A. allows manufacturers to add optional ingredients including vitamin D and calcium in the quantities noted below.

	Min.	*Max.*	
Vitamin D	250	1000	(U.S.P. units per lb.)
Calcium	500	625	(mg. per lb.)

Enrichment's Simplicity. Enrichment is really a simple process. The enriching ingredients (vitamins and minerals) are added to the food during processing. The consumer then receives farina or pastina which equals or exceeds the values of the original wheat in vitally important vitamins and minerals.

Physicians, nutritionists, dietitians —and consumers—support enrichment enthusiastically. It is such an important factor in public health that not only farina and pastina and other macaroni products, but family white flour, white bread and rolls, corn meal and grits and white rice are enriched.

Duplicating Nature. The science of chemistry is so advanced these days that many of Nature's complex substances can be duplicated in the laboratory. This has happened with many vitamins. First, the chemical composition is learned. Second, the pure substance is isolated. Third, a "duplicate" is made by synthesis. And fourth, the laboratory techniques are extended to large scale operation. The manufactured duplicate is identical chemically and in biological activity with Nature's own product. A vitamin is still a vitamin regardless of its source. So efficient is large scale manufacturing that vitamins are sold at a lower cost than if they were extracted from natural sources.



The Hoffmann-La Roche people make top-quality vitamins actually by the tons. To do this they use amazingly complex processes with scientific production controls and the latest equipment which fill buildings each a city block square and many stories high.

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some reference to the new procedures recently introduced by means of which bread, of the standard of that made from bleached and improved or matured flour, can be made from unbleached or untreated flour. It was Gordon Hay, the chief chemist of Ranks, Ltd., who first made this novel suggestion. The method is described in British Patent 646311 and, broadly, is as follows: Half the flour, all the yeast and all the water are mixed in an exceptionally high-speed mixer (350 r.t.m.) for some 4-8 minutes. At the end of this time the salt and the remainder of the flour are mixed in at ordinary speed. The dough becomes bleached and its character is that of a dough made from the same flour but treated. The bread is of the standard of bread made from treated flour. The process has been worked commercially and is especially useful with long-extraction flour, since this contains a good supply of oxidase. With white flour and indeed often as a precaution, unprocessed soya flour (about 1 in 1,000) is added. Now the government in Great Britain has permitted the use of chemical, it may be that there will be little future for the process, but it should be most useful in countries where treatment is prohibited.

It is not surprising that many varieties of this process have been made as, for example, by increasing the time of mixing and the amount of soya so that the speed of mixing can be reduced. It should, however, be remembered that the changes that take place by these mixing systems are not physical, but are oxidative in character, and are brought about by the action of the air on the dough at the high speed. The minor but important changes brought about in the protein are detectable by means of chromatography and are probably similar in nature to those which occur when chemical improvers are used.

I hope that the picture I have given you of the facts about postwar bread in Great Britain and recent developments in cereal chemistry has been of interest to you and that it may promote much thought among you. There is little doubt that the subject will continue to be hotly debated in Great Britain, and there is undoubtedly a sharp division of opinion between the millers and bakers and many nutritionists who still cling to the belief that there must be some great advantage in milling to long extraction. Indeed, for a number of reasons which it is not possible or politic for me to mention, a pronouncement on the subject is due in the next few months.

——BREAD IS THE STAFF OF LIFE——

Wheat Handling Problems

Various wheat handling problems were discussed during a roundtable session at the 1955 meeting of the Grain Elevator and Processing Superintendents. Following is a summary of the roundtable issued by the association after the meeting:

The subject first discussed was the cleaning of garlicky wheat. The consensus seemed to show that this problem was difficult of solution and several methods had been employed with little success.

Garlicky wheat is not a constant year to year problem, although the St. Louis district is a quite heavy producer. The several stages of the garlic bulb development were investigated and the green bulblet seemed to be perhaps the easiest cleaning time. Flotation was reported not a successful method of cleaning, nor was scouring. The suggestion was put forth that this problem should be given to manufacturers of cleaning equipment for their advice and recommendations.

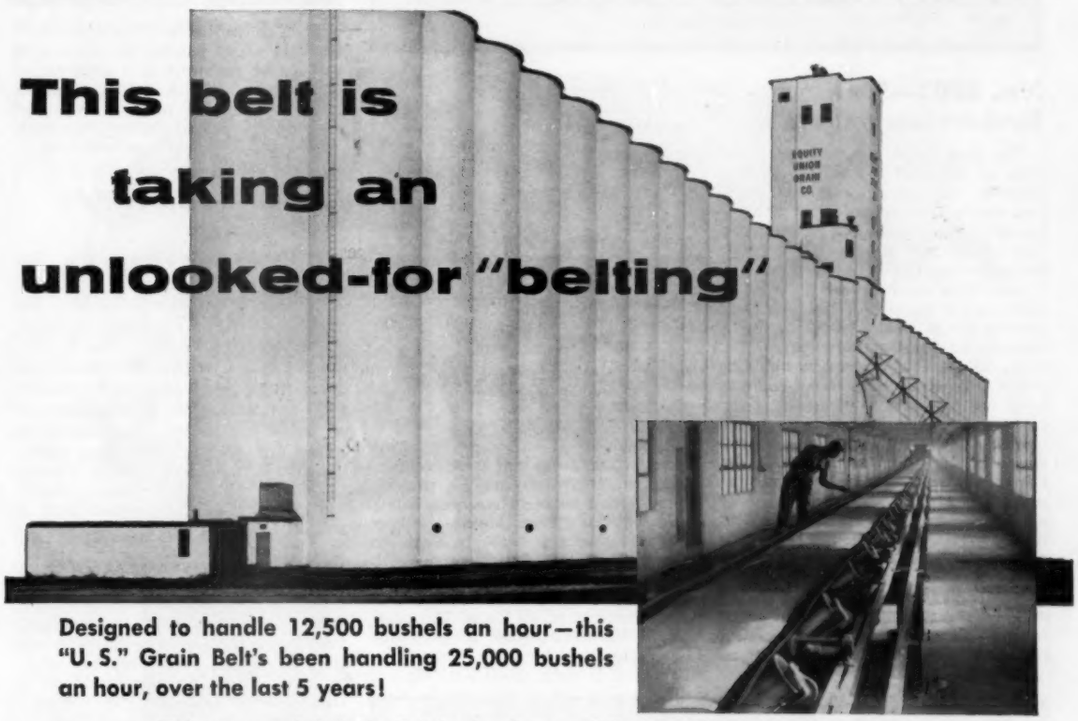
Smut is a decreasing problem; cleaning and aspirating are effective in most cases, followed by fumigation to remove the smut odor.

Handling Methods

Next on the agenda for discussion were wheat handling methods in terminal elevators. Temperature recording systems were discussed at length. Their good qualities and some disadvantages were brought to light. The air temperature and humidity of various sections of the U.S. and Canada have a great effect on keeping qualities. Some sections reported temperatures as high as 105° and others down to zero and below. It was the unanimous conclusion that turning and aeration are most vital in all localities.

In milling wheat operations, it was disclosed, most milling processors treat their grain whether or not any evidence of insect infestation is shown. This was said to be an excellent operation.

Blending of grain was the subject of a short discussion. Some operators had as many as 19 different varieties and classes of grain to make a blend. It is becoming increasingly noticeable that the protein content is a merchandising factor, especially in export sales. In soybeans the oil content is most important in merchandising. Some elevators are employing chemists to analyze wheat and report on baking qualities and proper blend necessary.



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(over ordinary duck)

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- "U.S." cotton-nylon grain conveyor belts can be used without rubber covers (friction surface) for handling bags of grain on slider bed conveyors, because of high resistance to abrasion, Rayon will have shorter life in this service.

(over ordinary duck)

- Nylon filler provides excellent troughability, allowing true running when operating on 45-degree troughing idlers or over concentrator rolls.
- High fastener splice strength—*wet* or dry.
- High strength of cotton-nylon allows longer centers, higher capacities.

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No. 5267—Size Reduction Machine

The Cog Corp. has announced details of its size reduction machine, utilizing the impact-in-air principle and which permits flexibility of blade spacing, rotor speed and screen sizes. The unit is now in use generally for taking screenings and reducing them to a uniform mesh. Abrasive resistant parts are used and 10 h.p. units are turning out several tons per hour, according to the manufacturer. The firm claims that thorough blending can also be achieved. Various ingredients can be proportioned ahead by means of proportioning feeders, delivering them into the comminutor which blends them so that no marbling can be detected. This method permits continuous blending. Also, by applying the spray-blending technique, wet ingredients can also be proportioned at the same time that dry ingredients are being fed through the unit. In this fashion, protein and vitamin solutions have been used to fortify animal feeds, obtaining a thorough dispersion with proportions ranging down as low as ½ to 1%, it is claimed. The unit is dustless in operation, is easily taken apart for thorough cleaning and simple maintenance. Many different end products can be obtained from the same unit by proper dual purpose blades, various screens and the selection of many speeds. The units range from 3 to 300 h.p. with combinations of inlet and discharge to meet individual needs. Secure more complete details by checking No. 5267 on the coupon and mailing it.

No. 5260—Plastic Coating

A new plastic coating for finishing concrete surfaces such as floors, silos and grain elevators with a smooth, glossy, hard surface has been introduced by American Metaseal Corp. The manufacturer says its Metaseal Plastic Coating provides a permanent, scuff-resistant, porcelain-like finish when applied to concrete and masonry surfaces of all kinds. The coating is 100% polyester plastic with added pigments for color. Claimed to outlast conventional chlorinated rubber and alkyd paints, the coating is said to be resistant to a wide range of solvents, alkalis, foods, chemical preservatives as well as oil and grease. For more information, check No. 5260 on the coupon and drop it in the mail.

No. 5269—Portable Vibrator

The Cleveland Vibrator Co. announces the development of a new lightweight, portable vibrator, the type LSRRH. The vibrator is designed for heavy duty use on portable bins, trucks, concrete forms and large pipe forms that do not require permanent vibrator installation. It develops 7,000 to 8,000 vibrations per minute at maximum efficiency. This new vibrator is available with cast steel bracket for easy attachment. Check No. 5269 on the coupon and mail it to secure more details.

No. 5278—Moisture Meter

Moisture determinations of grain, flour and other cereal products in less than one minute with accuracy within ½ of 1% is claimed by Marconi Instruments, Ltd., for its portable moisture meter. The manufacturer says no preliminary weighing is required and errors due to temperature or moisture distribution in whole kernels are reduced to negligible proportions. The meter can be calibrated for use with oilseed meals, most types of animal feeds, etc., the manufacturer says. The unit is fully portable and may be obtained with A.C. line converter or long-life batteries. For more information check No. 5278 on the coupon and mail it to this publication.

No. 5273—Tractor Shovel

A 15-cu.-ft.-capacity tractor shovel for in-plant handling of bulk materials has been added to the Michigan line of rubber-tired tractor shovels by the Construction Machinery Division of Clark Equipment Co. The new machine, designated the model 12B, features a power-shift transmission, a torque converter with 3 to 1 torque multiplication, a planetary wheel axle and low level bucket action.

Dust protection features include a filter for the torque converter oil and the power shift transmission oil and a partial flow filter protects engine lube oil. Transmission, torque converter, starting motor, distributor and generator are all sealed. There is a single power-shift lever on the steering column. Low is all the way forward, 5.6 miles per hour; high is in the middle, 11.2 miles per hour; and reverse is all the way back, 10.25 miles per hour. Secure more details by checking No. 5273 on the coupon and mailing it.

No. 5272—Grain Sanitation Bulletin

A bulletin entitled, "Sanitation in Primary Elevators" has been made available by Mill Mutual Fire Prevention Bureau. Called bulletin S-200, this revised and up-to-date publication on sanitation and infestation is intended to be of aid to the grain trade in reducing contamination by insects, rodents and birds. Insect infested grains and grains contaminated by rodents or birds are subject to down-grading wherever found, the organization states. They are also subject to seizure or being graded "unfit for human consumption." Bulletin S-200 deals with ways and means of avoiding such losses, it is stated. Secure the bulletin by checking No. 5272 on the coupon and mailing it.

—BREAD IS THE STAFF OF LIFE—

Chemists Help Plant Breeders Combat Rust

EDITOR'S NOTE: The accompanying article is a summary of a paper presented by Dr. J. A. Anderson, chief chemist, Board of Grain Commissioners, Winnipeg, at the annual conference of the Chemical Institute of Canada held in Quebec City recently. The paper dealt with research on the macaroni-making quality of durum wheats.

The fight against the new race of stem rust, 15B, that did so much damage to Canadian wheat last year, illustrates another facet of the chemist's work. He helps the plant breeder to produce rust-resistant varieties. In breeding new wheats, every cross produces hundreds of progeny, of which only a few have the rust-resistance, high yield and other agronomic characteristics required in a good variety. But quality for making bread or macaroni must also be maintained, and it is in testing for quality that the chemist's help is needed.

A couple of decades ago, quality tests took much time and more grain than could be spared. Samples had to be milled into flour and then baked into bread or processed as macaroni. With durum wheats, which are used for macaroni, a couple of simple chemical tests, requiring only a few minutes and about 20 grams of wheat, now serve to assess the macaroni-making quality of a new variety. Since durum wheat was particularly hard hit by rust, the maintenance of the premium market for high quality Canadian durum depends on the early development of new rust-resistant

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varieties. Chemical testing procedures developed in the last year or two are of great practical help in this program.

Few people realize how much research lies behind these developments. Dr. J. A. Anderson, chief chemist of the Board of Grain Commissioners, illustrated this point at the conference of the Chemical Institute of Canada by reviewing the history of durum studies in the Grain Research Laboratory at Winnipeg. The durum section was formed some 20 years ago, but, until recently, never had a staff of more than one chemist and one technician.

When the work was started in the early 30's, principally nothing was known about quality in durums. The first stage of the studies involved designing and building laboratory equipment for making macaroni under controlled conditions, and for making quantitative and reproducible tests of its strength, cooking, eating, and other properties.

The early equipment was on a rather large scale, since it simulated commercial plants, and was cumbersome to use. Nevertheless, it served for a survey of the variations in quality among different varieties, and of those variations caused by differences in the weather from year to year. It turned out that almost all samples had properties falling within an acceptable commercial range. The exception to this statement involved color; consumer preference is for a bright amber-yellow product, and many samples failed to meet this requirement.

Pigments in Wheat

The color is due primarily to the yellow pigments in the wheat. Methods of extracting and measuring these, and of making quantitative assessments of the finished macaroni, had to be devised. But correlation studies later showed that the amount of pigment in the wheat, or in the semolina milled from it, was not closely related to the final color of the macaroni.

Refinements in testing procedures, involving preparation of a flat disc in place of tubular macaroni, a specially designed instrument for measuring translucency, and other developments, failed to solve this problem. They did lead, however, to a quantitative study of the disappearance of pigments during the various stages of processing.

The mixing stage was found to be mainly responsible for pigment destruction, and it was also shown that destruction ceased when mixing stopped. This made possible a kinetic attack on the problem—a precise study of the rate of disappearance of pigment designed to shed some light on its chemical mechanism.

In the meantime, partly as a result of developments in other areas of chemistry, another line of research had shown by chromatography that the pigment was not carotene, as earlier supposed, but a mixture of xanthophyll and taraxanthin. But such differences as occur in the distribution of these pigments in different wheat samples and in macaroni made from them offered no explanation of the color problem.

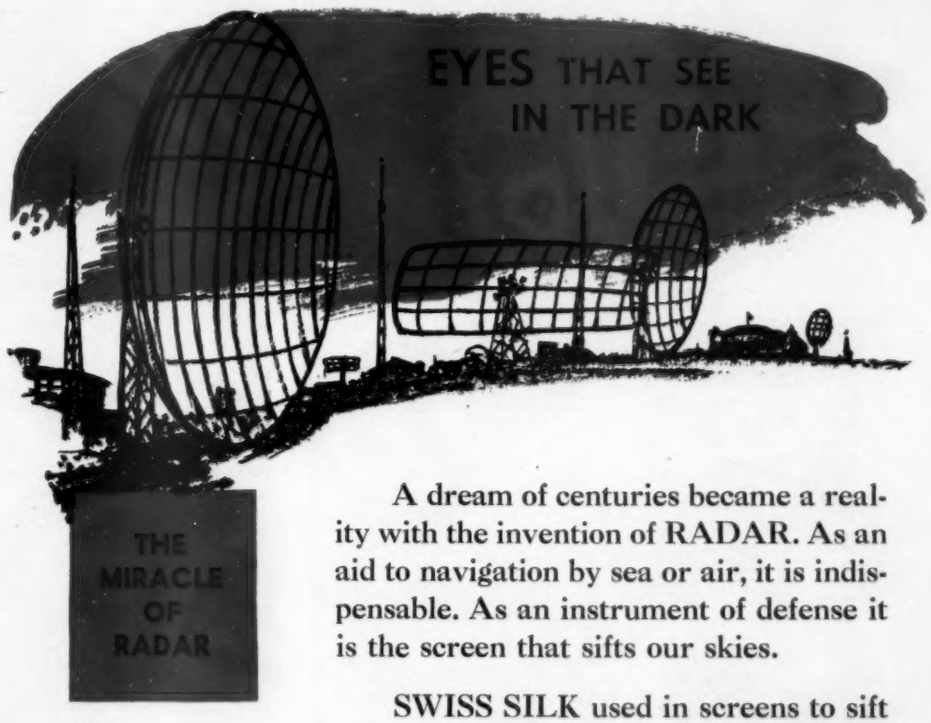
Missing Factor

At about that time it was postulated that the loss of pigment was caused by a coupled reaction involving oxidation of unsaturated fatty acids by the enzyme lipoxidase. A long series of investigations was required to work out the kinetics of this system and verify the hypothesis. It is now firmly established that the missing factor in predicting macaroni color has been lipoxidase. Moreover, a rapid manometric method of measuring lipoxidase activities has also been developed.

Many other lines of research have been carried concurrently and have contributed to our knowledge of macaroni-making quality. For example: the development of precise methods of making a single strand of macaroni from a very small sample; studies of the brown color that develops in certain samples; and studies of the role of air bubbles in affecting the appearance of macaroni pastes. But lack of space forbids accounts of these.

The practical outcome of the research has been that the chemist can now predict the quality from the results of two simple tests. He measures the pigment content and lipoxidase activity. The variety will normally produce good macaroni if the pigment content is high and the lipoxidase activity low. A technician can now take a couple of hundred new progeny and tell the plant breeder in a day or two which to discard and which to keep for further development in his elaborate and time-consuming field trials.

Here is a typical example of the way of research. It starts with a practical problem. At first this must be attacked superficially by empirical methods, e.g., by making and testing macaroni. Eventually the key problem is isolated; in this case, the problem of pigment destruction during processing. Basic research on the key problem eventually leads to sound and adequate knowledge of the chemistry involved. Having dug down from the practical level to the basic principles, the chemist is then able to apply his new found knowledge. He devises his simple tests and uses them to help the plant breeder. Only by this kind of cooperative attack can rapid progress be made in combatting the threat of stem rust.



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Milling Industry Progress

EDITOR'S NOTE: The retiring and newly elected presidents of the Association of Operative Millers recently took note of some of the advances in flour milling and also of problems involved in future progress. Their remarks, made at the AOM conference in St. Louis, are of interest to mill management as well as operative millers, and the accompanying articles are excerpts from their conference talks. Oscar Nelson, King Milling Co., Lowell, Mich., the retiring president, pointed up some of the advances made in milling, and he also cited some of the beneficial activities of the AOM. L. C. Robinson, Colorado Milling & Elevator Co., Denver, newly elected president, noted some of the milling industry's problems, including the problem of flour consumption, and he suggested things operative millers might do to help improve the condition of the industry, including the making of better flour.

President's Address

By Oscar Nelson

Progress has been so rapid and consistent in the milling industry during the past 10 years, that it would be unfair to point out any one of them and call it the year of progress. In fact, the advance has been so rapid that only the most alert have been able to remain abreast of it, and that trend is still gaining momentum.

All this has been made possible through the cooperation, the free exchange of known facts, and the exchange of ideas by personnel of every industry, every factory and every shop which has the slightest connection with the milling industry.

The principal media for this exchange of facts and ideas has been the Association of Operative Millers by contact, by participation in the trade show, by publication in the milling journals and AOM bulletins, or by advertising and personal contact by the allied tradesman.

The large space taking machinery has been replaced by small, compact, accessible and efficient machines with sanitation being the No. 1 built-in feature. The old cloth and used container has given way to a sanitary paper container or transported in bulk by vacuum or pressure. The 196-lb. barrel and the 140-lb. sack have passed on. The universal package differential based on the 100-lb. sack has been a blessing to all concerned.

Brute strength handling of heavy containers is obsolete. Vitamins and minerals have been added to improve the general health of our people and so today when a customer picks up a package of flour or meal at the market place, they can be sure that they have a package of the cleanest, purest, most wholesome and nourishing flour or meal that has ever been available to them.

Many of the ideas, methods and systems which have helped to bring this about, have been given to us by our friends from foreign lands and we should not be too proud to be grateful to them.

Association Progress

The association has gained a great deal of position in the last few years. We are in the spotlight. There are three active working committees which meet twice a year. They are the educational, sanitation and technical advisory committees. The educational committee tries to teach people in the industry the proper care of grain from the farmer's field to the mill proper and also the cleaning and processing methods. They are preparing a millers' handbook which contains information on all phases of milling. Prof. Eugene P. Farrell of Kansas State College is chairman of that committee.

The technical advisory committee with Tibor Rozsa of Pillsbury Mills, chairman, has invited many machinery and equipment manufacturers to appear before them and confidentially pass upon the good and bad points, if any, and make recommendations accordingly.

The sanitation committee, with George Wagner of Pillsbury Mills as chairman, works on all matters of sanitation as well as chemicals and methods of application for elimination or eradication of filth and pests which seek to feed upon grain and grain products.

These three committees, along with the tireless efforts of our executive vice president and secretary, have done much to help gain the position we now hold in the industry. Our association is consulted and advice solicited by such organizations as the Millers National Federation, the National Soft Wheat Millers Assn., the state and federal pure food administrations, the state and federal de-

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MODEL	MATERIAL	FLOW RATE Lbs./Min.	Lbs./Hr.
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XB24	di-cal	420	25,200
XB24	calcium	850	51,000
XB24	ground oats	280	20,800
XB24	bran	170	10,000
XB24	pellets (checkers)	570	34,200
XB48	ground corn	1600	96,000
XB48	mids	670	40,200
XB48	bone meal	1440	86,400
XB48	tankage	1500	90,000
XB48	soybean meal	1400	84,000
XB48	corn gluten feed	1100	66,000
XB48	flax screenings (light)	600	36,000
XB48	alfalfa	500	30,000
XB48	ground screenings (light)	600	36,000
XB48	bran	1100	66,000

You, too, can get capacities like these, with the Exbinner. It makes active a greater portion of the bin bottom . . . eliminates bridging, flushing and segregation of materials . . . discharges smoothly and continuously. It's hard to beat as a machine feeder or in automatic mixing processes . . . or wherever materials have to be removed from deep storage bins.

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partments of agriculture in matters of wheat improvement, the effect of commercial fertilizers, wheat varieties, etc. There are members in the association who can give expert advice in every category from preparation of the soil, the seed, growth and development, harvesting, storing, cleaning, processing, packaging, handling, shipping, baking and finally taste and flavor.

Cereal Chemists Help

The cereal chemist has been an important guide to the operative miller in producing an acceptable product. This matter of milling is becoming so scientific and complex that no one person will know all the answers and that is why our job is never motonous.

If we are willing, we can always learn more, and one of the important functions of the association is to keep its members well informed on new methods and new developments. Many have taken advantage of the association's correspondence course. Some companies conduct regular classes for their employees using the correspondence course as a basis of their studies. Self improvement is an important factor in any endeavor.

The 14 districts have been very active during the past year. The attendance has been very good and their programs have been excellent. Some of you have considered it advisable to hold joint meetings with an adjoining district, others have started inspiring essay contests or have met with the cereal chemists. One district had a special meeting last summer at Dover, Ohio. The sanitation committee sponsored a special sanitation program at Kansas City which was well attended and very successful. The younger districts, that is Intermountain District No. 12, Canadian Prairie District No. 13, and Rocky Mountain District No. 14, are growing rapidly. Southeastern District No. 11 has the distinction of having the first lady miller classified as an active member.

I have had the pleasure of attending several of the district meetings during the past two years and Don Eber has attended all of them except when two meetings were being held on the same dates. L. C. Robinson has also attended many district meetings, especially in the far West. We want to congratulate all of you district officers, past and present, for your excellent performance.

v v

Inaugural Address

By L. C. Robinson

At this time I would like to suggest a few things we, as operative millers, might do to help improve the condition of the milling industry and to submit a suggested plan of action.

We have heard of some of the technical improvements that have been made by European and other foreign millers. We in North America seem to have lagged behind in installing improved methods. Possibly here is one area in which we can be helpful by bringing improvements to the attention of our companies and the industry generally, not so much to enable us to expand our foreign markets, but rather to improve our position in the domestic food market by making better flour at reduced costs.

Under present conditions it seems to me that U.S. millers have but limited possibilities in the export trade. The supply of wheat outside the U.S. is more nearly adequate for the demand than it has been for many years. Coupled with the increased supply of wheat, many new mills have been built recently in Europe and South America and older mills have been improved, so I say we have but limited possibilities from exports. While there are some indications of food shortages behind the iron curtain, we cannot be sure, and even so any such shortages would hardly be made up by exports from us.

Let's take a look then to our domestic picture for areas in which we can be helpful. Milling in the North American Continent is going through various changes, some good and some bad. Very few new mills are being built and most of those that are being built are formula feed mills. Many new advancements in animal husbandry, together with good living standards, have created more demand for poultry and livestock, and this has increased the demand for prepared feeds. Recently, therefore, we have probably done a better job on formula feeds than we have on flour.

Flour Consumption

It is discouraging to note that the domestic per capita consumption of flour has again fallen slightly, although the increase in population has offset any loss in actual production. Food faddists have hurt consumption of wheat products a small amount, but thanks to the publicity of many dietitians, the Millers National Federation, the baking industry and others, this has been largely offset. Our basic problem, it seems to me, is to find means of getting a larger share of the consumers' food dollar than we are now getting. I am not attempting to say that people are eating less, because I believe our people are eating better. Frozen foods, fruit, meat and vegetables are offered in a variety of forms, many fully prepared for the table. I believe that this is an ad-

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For a *thorough* mill clean-up of insects and rodents, you can depend on Aero Liquid HCN. When properly applied by an Industrial Fumigation Engineer, Liquid HCN penetrates nooks and crevices in your plant . . . destroys insects, insect eggs and rodents.

And Liquid HCN has no injurious effect on grain and flour stocks. It leaves no taste or odor after proper aeration . . . it does not affect the baking qualities of flour.

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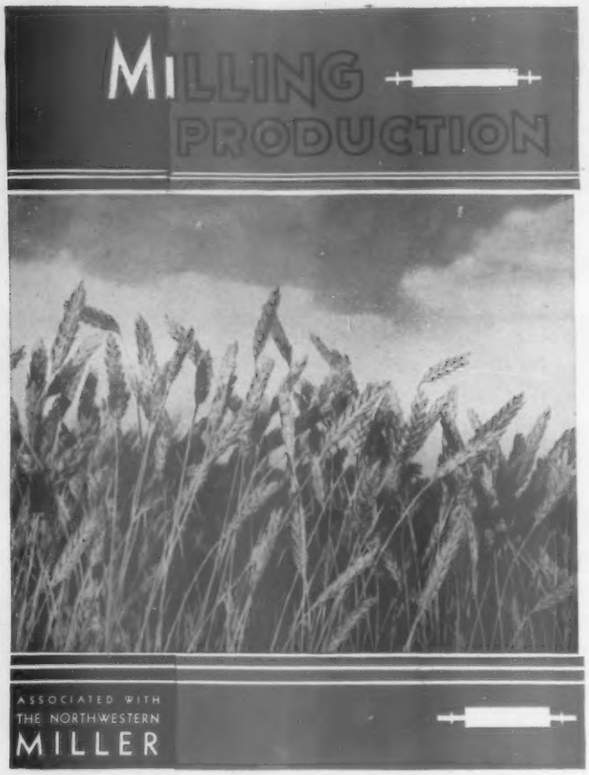

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1. WORKING CIRCULATION—Studies of flour manufacture show that about 300 of the mills in this country produce 98% of the flour. Milling Production with its controlled circulation reaches more than 1,000 key men in these important flour mills. This working circulation provides contact each month with the people who directly or indirectly control the buying—superintendents, operative millers, chemists and plant managers. *There is no waste circulation—only working circulation*—and you are assured of reaching your potential customers in the most productive mills.

2. LEADERSHIP MAKES READERSHIP — Readership surveys and unsolicited correspondence from its readers attest to the editorial leadership of Milling Production. That editorial leadership is held by complete words-and-pictures reports of the latest milling technology, current news, features and complete coverage of the activities of the industry's two technical associations. *The real price the reader of a publication pays is the amount of time he puts in reading that journal.* Over one half of the readers of Milling Production have requested that it be sent to their homes so that they may enjoy uninterrupted reading pleasure.

3. DOUBLE-DUTY DOLLARS—Money spent for advertising in Milling Production does double duty. In addition to reaching the production personnel, the advertiser's message is read in the Milling Production Section of The Northwestern Miller by the executives who approve purchase orders. *No other advertising medium in the flour milling industry offers this double-duty feature of reaching both groups*—mill technologists and executives—with the same advertising message and for the cost of one advertisement. Take advantage of this 100% coverage through one double-duty advertising contract.

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vancement in our over-all standard of living, but our problem in the milling industry is how to recapture a portion of this business that has gone elsewhere. The lower per capita consumption of flour over a period of many years has disrupted operations in many plants, meant less profit for mill owners and fewer jobs for members of our association.

Some of the milling companies have devised effective advertising means to bring about a greater consumption of flour. For example, the contests conducted by Pillsbury Mills for new recipes have created many new and useful foods made from flour. The Millers National Federation and the Wheat Flour Institute have cooperated with restaurants and hotels in securing greater usage of wheat flour products. The bakers have rendered excellent service by advertising bakery products on TV, radio, billboards, and in the newspapers. Home economists, in conjunction with various state and federal governmental health services, have shown that wheat products are one of the seven basic foods and should be included in our menus.

I believe that we as operative millers can make this advertising even more effective in increasing the per capita consumption by making a better flour—one that, when people sit at a table, the baked products will be so delicious that the people will eat more of them.

I am sure we have all had the experience many times when sitting at a table of having tasted hard rolls, bread, or other baked products that were so good that we ate many times the amount that we have when these products were tasteless or unattractive. I am sure we all realize that good bread can be made good, only with good flour as the first requisite. The baking industry realizes this, for in the last few years the trend of bakery buyers has been to demand and purchase better flour.

Prepared cake mix manufacturers have proved this in the last few years. At first, some of the cake mixes were made from cheaper flour and cheaper ingredients. Now that these manufacturers are using the best quality flour and good ingredients, the public is buying more than was anticipated in the fondest dreams of some of the early prepared cake mix manufacturers. I, therefore, charge us as operative millers to make a better flour if we want to increase the per capita consumption.

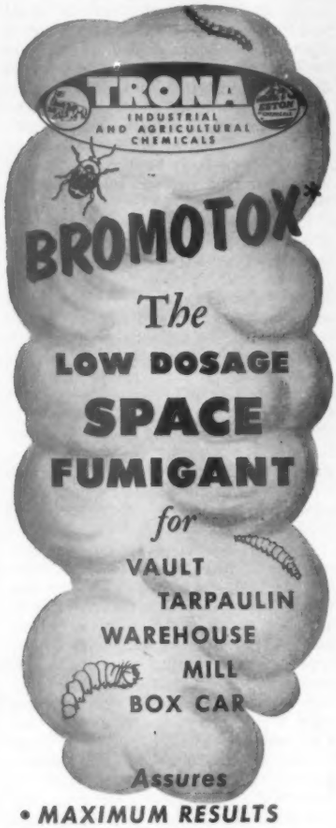
Points to Consider

The problem of making a better flour is manyfold. First, we require good quality wheats. We should, therefore, bring to the attention of farmers and state and federal agriculturalists the importance of developing and raising wheat varieties that produce good flour, and not solely those varieties that will produce more bushels to go on the government loan. This is a most important factor for our government to consider, both for domestic and export markets.

Second, our millers, chemists and bakery technologists should improve our milling processes so that we can make a better flour, one with more tolerance in the bake shop and not simply one that meets an ash and protein specification or gives the best yield percentage, or is the cheapest.

Third, our research and education committee can assist. I need mention only the problems relating to tempering. I am sure that through research we can devise better control in our mills on this phase of our operations. In fact, I believe we can, with properly tempered wheat, improve our flour quality vastly even without other changes in the milling process and with the present wheat varieties.

Fourth, milling machinery manufacturers all over the world must improve milling machinery by giving us better mechanical and electronic controls. Even with all the vast knowledge in electronics, mechanics, chemistry, and agriculture, there has been very little advance in recent years in milling except possibly in air handling of our products. I think manufacturers of machinery and we as



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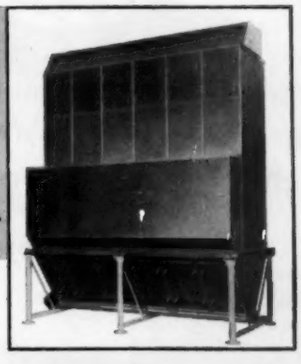

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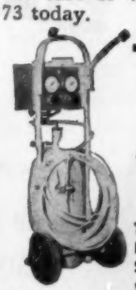

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operative millers should interest more of the people who know something about electronics, chemistry, etc., in our problem and seek their advice and counsel.

I hope our association will become more active in bringing the matters I have discussed to the attention of industry leaders, our own companies, and the Millers National Federation. I believe that worthwhile results can be achieved from such a program and that we can do much through our various committees, particularly our research committee, in the coming year to help promote such a program.

Rodent Control Problems

In connection with rodent control, consideration should be given to recent findings dealing with the origin and transmission of rodent filth.

This advice was given by W. W. Dykstra, biologist, U.S. Department of the Interior, at the last National Grain Sanitation Conference.

Following is an excerpt from Mr. Dykstra's talk:

Foremost among the recent findings regarding the origin and transmission of rodent filth is that mice, and not rats, are responsible for most of this type of contamination. Other data reveal that a sizeable portion of such objectionable material originates at the field level.

Another new finding, derived from studies by Wagner and Schoenherr, concerns widespread occurrence of air-borne pollution, particularly rodent hair fragments, much of which is apparently brought into elevators, mills and food plants from the surrounding atmosphere.

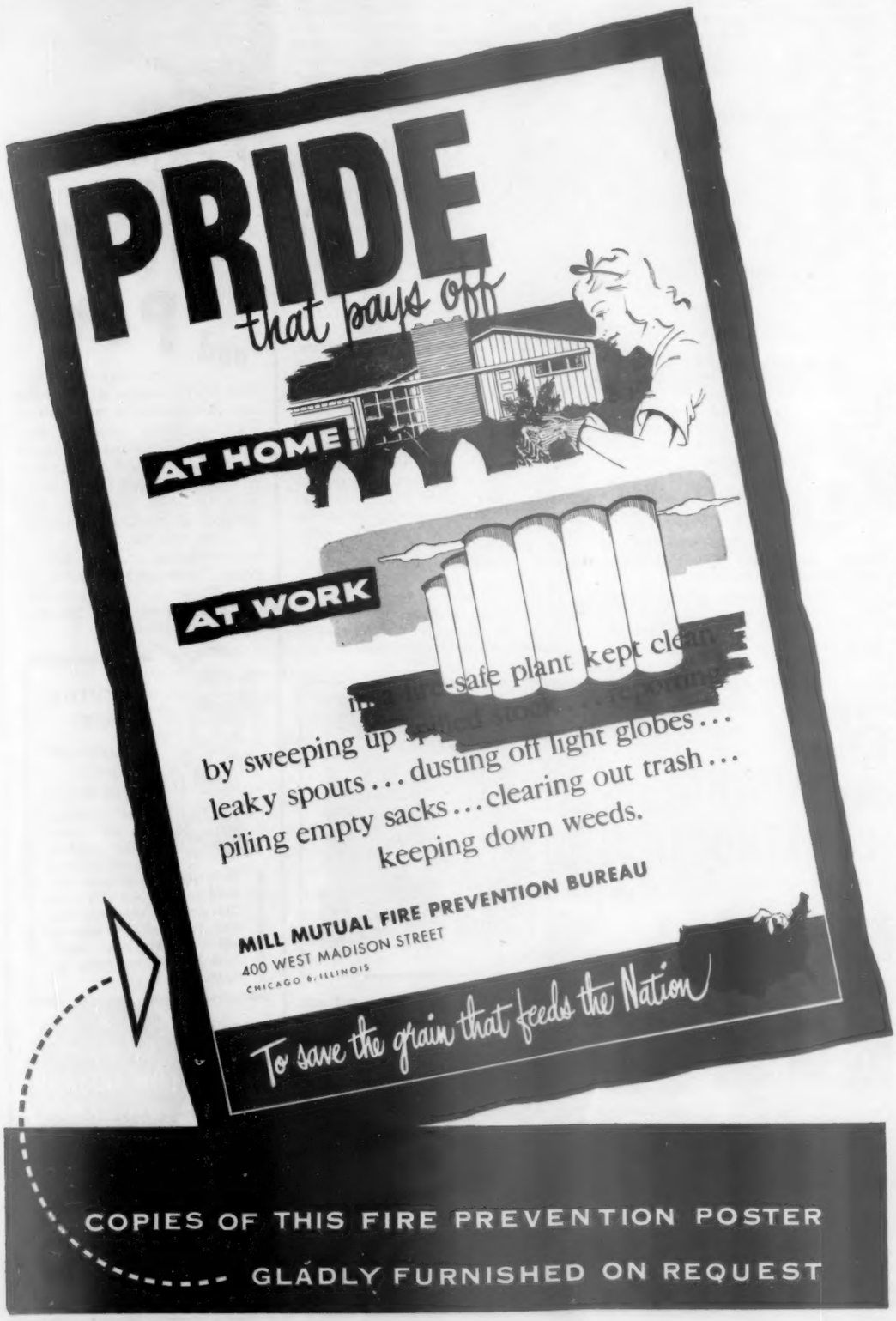
In view of these important discoveries, it is apparent that we must alter our concept of rodent control techniques recommended to the general public as a means for preventing food contamination. Old-fashioned rat poisoning campaigns will not do the job. Effort must be redirected to prevent rodents from gaining access to areas where food is present, and it must be expanded to place greater emphasis on mice.

Proper recognition should also be given to the part played by birds and insects as further sources of contamination. Even if rodents are successfully controlled, the continued presence of these other creatures would still prevent attainment of the clean food objective. Thus, because of the many forms of filth, and the varied locations of their origin, an important requirement for a sound program is the organization of well-balanced farm and community-wide sanitation projects that give due consideration to many procedures and management practices helpful in preventing all types of pollution.

Rodent phases of such projects need technical assistance from trained mammalogists who are thoroughly familiar with the habits and control of these animals, which have little in common with other types of pests. After 40 years of experience in injurious mammal control work, carried out in cooperation with many agencies and groups, the Fish and Wildlife Service is acutely aware of the necessity for proper guidance to avoid failures resulting from misdirected effort. For example, it is generally too late to prevent food contamination by rodent hair when you use a rodenticide inside a plant or storage structure; yet that is the location where probably three-fourths of the poison baits are exposed at the present time.

It is particularly important for the public to recognize such limitations in the use of control agents. Highly effective products are available for killing rats and mice, but they must be applied more extensively out of doors, in strategically placed permanent feeding stations, to attain the desired degree of wide-area perimeter control around granaries, elevators and food plants. In some cases, the area requiring protection may include entire farms, railroad right-of-ways, stream embankments and urban business districts. For these reasons, provisions for united community action are needed to supplement individual effort.

—BREAD IS THE STAFF OF LIFE—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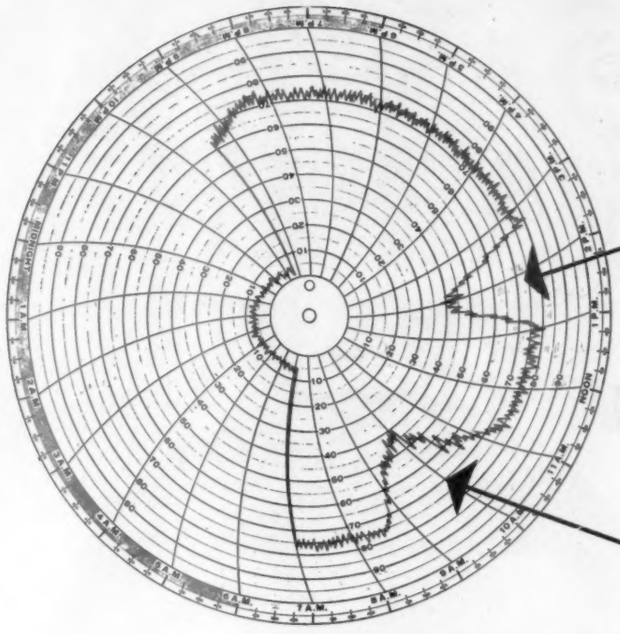
Symposium on Physics In Food Industry Set

SAN ANTONIO—The first international symposium on "Physics in the Food Industry," sponsored jointly by Southwest Research Institute and the Institute of Food Technologists, will be held in San Antonio March 15-16, 1956, at the Plaza Hotel.

The purpose of the symposium is to explore with key technical persons in the food industry the contributions physics can make in the ways of preserving, packaging and processing foods in the future.

Authorities will present for discussion technical papers on applications of physics to the food industry. These subjects will include ultrasonics, X-ray and gamma-inspection, electrostatistics, dielectric heating, radiation sterilization, raidofrequency spectroscopy.

John O'Meara of Southwest Research Institute is program chairman for the symposium.



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But... no matter *what* causes the flow variation in the flour stream ... it's spotted the INSTANT it happens. One look at the graphic recorder operated from the W&T Massometer or Merchen Scale Meter tells the story. Even the smallest momentary fluctuations in flow rate are detected immediately and recorded accurately by these mill "watch dogs."

W&T Massometers and Merchen Scale Meters provide a continuous record — *by weight* — of actual mill performance. They tell you the *exact* flow rate of your streams and they pinpoint time and production losses.

Guaranteed to 1% accuracy, the Massometer will handle flour flows up to 200 pounds per minute... the Merchen Scale Meter, up to 600 pounds per minute. For other applications the Meter will handle flows up to 3000 pounds per minute. Both instruments have been tested and proved highly dependable in hundreds of installations throughout the country.

For complete information, write us today or communicate with your nearest W&T representative.

Massometer

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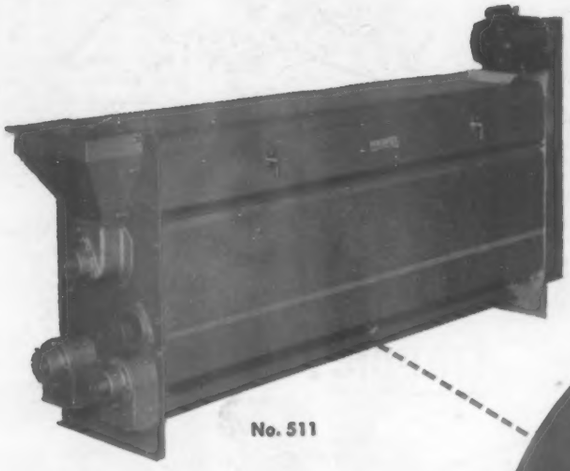

No. 511

No. 521

The CARTER DISC SEPARATOR *WORKING WITH* CARTER PRECISION GRADERS

No. 532

Because of its remarkable accuracy, the Carter Disc Separator is the world-standard machine for length separation and sizing. A companion machine, the Carter Precision Grader, is proving outstanding for thickness, diameter, and width separations. By combining the applications of these two types of machines you now can make complete separations that previously were impossible.

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